

Description

The invention relates to a circuit that couples a control signal from a control circuit to a utilization circuit that is conductively isolated from the control circuit.

Some television receivers have signal terminals for receiving, for example, external video input signals such as R, G and B input signals, that are to be developed relative to a common conductor of the receiver. Such signal terminals and the receiver common conductor may be coupled to corresponding signal terminals and common conductors of external devices, such as, for example, a VCR or a teletext decoder.

To simplify the coupling of signals between the external devices and the television receiver, the common conductors of the receiver and of the external devices are connected together so that all are at the same potential. The signal lines of each external device are coupled to the corresponding signal terminals of the receiver. In such an arrangement, the common conductor of each device, such as of the television receiver, may be held "floating" or conductively isolated relative to the corresponding AC mains supply source that energizes the device. When the common conductor is held floating, a user touching a terminal that is at the potential of the common conductor will not suffer an electrical shock. Such electrical shock may occur if the common conductor is not held floating. Furthermore, having the common conductor floating avoids an undesirable current flow, or a current loop, among the common conductors of the devices that are, as described above, connected together.

Therefore, it may be desirable to isolate the common conductor or ground of, for example, the television receiver, from the potentials at the terminals of the AC mains supply source that provides power to the television receiver. Such isolation is typically achieved by a transformer, as described below. The isolated common conductor is sometimes referred to as "cold" ground conductor.

In some television receivers the AC mains supply voltage is coupled directly to a bridge rectifier for producing an unregulated direct current (DC) input voltage. The unregulated DC input voltage may be applied to a switching, or chopper, power supply having a chopper transformer that generates regulated DC voltages. The regulated DC voltages are developed, typically, from a secondary winding of the chopper transformer, relative to the cold ground conductor. The chopper transformer conductively isolates the regulated voltages, thus causing them to be floating, relative to the potentials at terminals of the AC mains supply voltage source.

Circuit networks of the power supply that provide voltages that are not floating relative to the potentials at the AC mains supply voltage source terminals, such as voltages at the primary winding of the chopper transformer, are referenced to a common conductor that is, therefore, floating relative to the cold ground conductor and that is sometimes referred to as "hot" ground conductor.

Some television circuits that are energized from the regulated DC voltages utilize the cold ground conductor as the common conductor. When external video devices are coupled to the receiver, the cold ground conductor that provides current return path to, for example, the video signals of the receiver is also connected to the common conductors of the external video devices. Therefore, by making each of the common conductors floating, the above-mentioned undesirable flow in a current loop among the common conductors is eliminated. Furthermore, a user who touches the floating common conductor will not suffer an electrical shock.

It is desirable to maintain isolation between the hot and cold ground conductors of the television receiver when coupling a control signal from, for example, a control circuit of the television receiver that is referenced to the cold ground conductor, to a section of the power supply circuit of the television receiver that is referenced to a hot ground conductor.

In some television systems it may be advantageous to have the control section of the power supply referenced to the hot ground conductor; the on/off input signal that is generated by a remote control unit may be referenced to a cold ground conductor. In order to couple the on/off input signal that is referenced to the cold ground conductor to the control section that is referenced to the hot ground conductor of, for example, a switched mode power supply, some prior art circuits utilize a relay having a control winding that is conductively coupled to the cold ground conductor. In such prior art circuits, the on/off input signal that is referenced to the cold ground conductor is conductively coupled to the control winding of the relay. A pair of contacts that are magnetically activated by the current in the control winding are conductively coupled to the control section of the switched mode, or chopper, power supply that is referenced to the hot ground conductor. The closure and separation of the relay contacts controls the on/off operation of the power supply, in accordance with the information contained in the "cold" on/off input signal in the control winding of the relay. Both contacts of the pair of contacts are conductively isolated from the on/off input signal that is coupled to the control winding. Thus, the on/off input signal is magnetically coupled across the cold-hot barrier formed by the relay without affecting the conductive isolation

across the cold-hot barrier. A disadvantage of such on/off input signal coupling arrangement is that it is bulky, not highly reliable because it utilizes the moving mechanical parts of the relay, and consumes excessive power when, for example, the relay is energized.

In other television systems the on/off input signal coupling arrangement includes a photo-coupler that couples the on/off input signal by a cooperating pair of electrical-to-digital and optical-to-electrical transducers. A disadvantage of such coupling arrangement is that the level of the signal produced by, for example, the optical-to-electrical transducer is low. Such low level signal may be susceptible to noise. Another disadvantage is that such photo-coupler may be relatively expensive. Additionally, the conductive isolation in the photo-coupler between the input and output signals may not be adequate in some television applications.

DE-A-2024092 relates to a power supply with a DC voltage converter and a feedback regulation arrangement for providing a constant DC output. The DC voltage output signal is fed back to control the frequency of switching of an internal circuit which chops the input mains signal into a pulse frequency, which pulse frequency is subsequently rectified. This system is relatively complex for providing a constant DC output voltage and is not concerned with the problems of hot and cold ground conductors.

DE-A-3232554 discloses a remote control arrangement for a television receiver wherein the control simulates an abnormal operating condition.

The present invention provides a power supply apparatus, comprising a source providing a first on-off control signal having an on-state and an off-state for providing normal operation on-off control; means responsive to said first on-off control signal for generating a first AC signal conductively coupled to said source of on-off control signal, and of constant frequency during one of said on and off-states, and not during the other of said on and off-states; a signal transformer having a first winding coupled to said first AC signal for developing, in a second winding thereof, conductively isolated from said first winding, a second AC signal of constant frequency and width during said one state and not during said other state; a source of input supply voltage; and a normal operation power supply coupled to said source of input supply voltage and to said second winding of said signal transformer for developing only during the on-state of said first on-off control signal an operating voltage.

In accordance with the invention, a power supply control apparatus responsive to an input signal, that contains power on and power off control information, produces a control signal that controls the on-off operation of a power supply. A modulator

produces from a first signal, that contains an alternating current (AC) component signal, a modulated signal that is modulated in accordance with the input signal. The control signal is produced from the modulated signal.

In accordance with the invention, the modulated signal is magnetically coupled to the power supply such that the control signal, that is produced from the modulated signal, is conductively isolated from the input signal.

In carrying out the invention, the input signal has first and second signal states. The input signal modulates a carrier signal for producing the a modulated signal in accordance with the corresponding state of the input signal. Illustratively, when the input signal is at the first signal state, the modulated signal contains the AC component signal. In contrast, when the input signal is at the second signal state, the modulated signal does not contain the AC component signal. The modulated signal is applied to a primary winding of a transformer. The signal at the secondary winding of the transformer that is coupled from the primary winding of the transformer is conductively isolated from the control circuit and from the input signal by the isolation between the secondary and primary windings. The signal at the secondary winding is demodulated in a demodulator for generating the control or output signal having, for example, first and second signal states that correspond with the first and second signals states of the input signal. The output signal is coupled to a control terminal of a power supply that is conductively isolated, by the transformer, from the input signal for controlling the power supply in accordance with the first and second signal states of the input signal.

In an embodiment of the invention, the input signal is generated by a remote control circuit that is referenced to a cold ground conductor of a television receiver. When the input signal is at the first state, the television receiver power supply is turned on. When the input signal is at the second state, the power supply is turned off. When the input signal is at the first, or "power-on" state, a clock signal of a constant duty cycle is coupled to a primary winding of a transformer. On the other hand, when the input signal is at the second, or the "power-off" state, the clock signal is not coupled to the primary winding. The signal at the primary winding is thus amplitude modulated by the input signal. When the clock signal is coupled to the primary winding, the AC component signal of the clock signal is magnetically coupled to a secondary winding across a hot-cold barrier formed by the transformer. When the clock signal is not coupled to the primary winding, corresponding with the input signal being at the second state, the signal in the secondary winding does not contain the AC

component signal and is illustratively at zero volts. An amplitude demodulator demodulates the signal in the secondary winding to generate the output or control signal that is conductively isolated from the cold ground conductor of the remote control circuit. The output signal is coupled to a regulator of the power supply that is referenced to the hot ground conductor. Illustratively, the output signal remains at a "power-on", or a first state, as long as the clock signal is coupled to the primary winding, and remains at a "power-off", or a second state, as long as the clock signal is not coupled to the primary winding. The first and second states of the output signal correspond with the "power-on" and "power-off" states, respectively, of the input signal of the remote control circuit for turning-on and turning-off the power supply, respectively. In this way, each state of the input signal determines the corresponding state of the output signal that is conductively isolated from the input signal.

In a typical television display system, a high voltage ultor accelerating potential is applied to the final anode electrode of a picture tube to accelerate an electron beam generated at a picture tube cathode onto a phosphor screen. To ensure that the television receiver will not be operated under fault conditions at excessive ultor potential levels, a high voltage protection circuit is incorporated in the television receiver circuitry.

In carrying out an aspect of the invention, the high voltage protection circuit causes the shut-down of the high voltage power supply by the output signal of the demodulator. The output signal of the demodulator is at the "power-off" state when the high voltage becomes excessive.

In accordance with another aspect of the invention, a fault indicative signal that is referenced to the cold ground conductor and that is representative of, for example, excessive ultor voltage, is also coupled to the primary winding of the transformer that was described before. The fault indicative signal causes the output signal from the demodulator to assume the second, or "power-off", state that causes the shut-down of the high voltage power supply when the ultor voltage becomes excessive.

In the Drawing:

FIGURE 1 illustrates a block diagram of a television receiver power supply system that includes an on/off control signal generator embodying an aspect of the invention;

FIGURE 2 illustrates a first detailed embodiment of the on/off control signal generator of FIGURE 1, embodying another aspect of the invention;

FIGURE 3 illustrates a second detailed embodiment of the on/off control signal generator of FIGURE 1, embodying a further aspect of the invention; and

FIGURE 4 illustrates a circuit, embodying an additional aspect of the invention, that includes a microprocessor for generating the on/off control signal of FIGURE 1.

FIGURE 1 illustrates a power supply system of a television receiver. In FIGURE 1, an AC mains supply 30 provides a voltage V_{AC} that is conductively coupled to a pair of input terminals of a bridge rectifier 31. Bridge rectifier 31 produces, in a conventional manner, an unregulated DC voltage V_{INNR} at an output terminal 31a that is referenced to a current return terminal 31b of rectifier 31. Terminal 31b provides the potential of a first common conductor, referred to as a hot ground conductor 27. Voltage V_{AC} is also magnetically coupled by a transformer T1 to a bridge rectifier 32 that similarly produces an unregulated DC voltage V_{INSB} at an output terminal 32a that is referenced to a current return terminal 32b. Terminal 32b provides the potential of a second common conductor, referred to as a cold ground conductor 25. Voltage V_{INSB} is conductively isolated from voltage V_{INNR} because of the conductive isolation provided by the transformer T1.

Voltage V_{INSB} energizes a conventional standby power supply 33 that provides a regulated DC voltage V_{SB} to a conventional remote signal processor 34 even when the television receiver does not produce a raster. Remote signal processor 34 is referenced to cold ground conductor 25 and receives an input signal RM. Signal RM is indicative of "power-on" and "power-off" user commands that are initiated when such user wishes to turn on and turn off the display operation, respectively. Signal RM is conventionally generated by, for example, an infrared remote receiver, not shown in FIGURE 1. Signal RM is used in processor 34 for generating an on/off signal $R_{on/off}$. A first state of signal $R_{on/off}$ is used for turning on a normal operation power supply 38; whereas a second state of signal $R_{on/off}$ is used for turning off power supply 38. Processor 34 may include a microcomputer that processes signal RM for generating signal $R_{on/off}$ and that receives a clock signal CK1 for its operation. Clock signal CK1 is generated by a clock generator 35. Clock generator 35 includes, illustratively, an oscillator that provides an input signal to a frequency dividing chain, not shown in FIGURE 1. Clock signal CK1, that is obtained from the frequency dividing chain, provides a conventional clock signal to the circuitry of remote signal processor 34. Clock generator 35 also generates, for example, a 32 KHZ clock signal CK, obtained from the frequency dividing chain, that is not shown in FIGURE 1, used for generating a signal S_{cold} .

In carrying out an aspect of the invention, clock signal CK and on/off signal $R_{on/off}$ are coupled to

first and second input terminals, respectively, of an "AND" gate 36. Signal S_{cold} , developed on a line 37e at an output terminal 36a of "AND" gate 36 is referenced to cold ground conductor 25. When signal $R_{on/off}$ is at logical "TRUE", that is representative of the first, or "power-on", state of signal $R_{on/off}$, "AND" gate 36 causes signal S_{cold} to toggle alternately between logical "TRUE" and logical "FALSE" states at the frequency of clock signal CK. On the other hand, when signal $R_{on/off}$ is at logical "FALSE", that is representative of the "power-off", or second, state, signal $R_{on/off}$ prevents the clock pulses of clock CK from appearing on line 37e. Therefore, signal S_{cold} is continuously at logical "FALSE" state. Thus, "AND" gate 36 produces from clock CK signal S_{cold} that is modulated in accordance with signal $R_{on/off}$.

Signal S_{cold} is coupled to an input terminal 37a of an on/off control signal generator 37, embodying yet another aspect of the invention. Generator 37 is energized by a DC voltage V_{xp} that is referenced to cold ground conductor 25 and that is generated by standby power supply 33. Generator 37 includes a transformer T3 that magnetically couples, under normal operating conditions, the signal component at the frequency of clock signal CK that is contained in signal S_{cold} when signal $R_{on/off}$ is at the "power-on" state, for generating a corresponding "power-on", or first, state of an on/off input signal S_{hot} at terminal 37d. Signal S_{hot} , that contains only on/off control information, is referenced to hot ground conductor 27. When signal S_{cold} is at the logical "FALSE" state, occurring when signal $R_{on/off}$ is at the "power-off" state, signal S_{cold} does not include the signal component at the frequency of clock signal CK. Illustratively, as long as signal S_{cold} , that is coupled to transformer T3, does not contain a signal component at the frequency of clock signal CK, control signal S_{hot} is caused to be at a corresponding "power-off", or second, state. Control signal S_{hot} , that is conductively isolated from cold ground conductor 25 by the magnetic coupling of transformer T3 of generator 37, is coupled to an on/off control terminal 38a of a conventional chopper switch regulator control section 38c of normal operation switching power supply 38. Control section 38c is referenced to hot ground conductor 27. Control section 38c may include, illustratively, a driver transformer 38e that provides the drive signal to a chopper switch, not shown in FIGURE 1. Each winding of transformer 38e may be referenced to hot ground conductor 27. When signal S_{hot} is in the "power-on" state, chopper regulator control section 38c generates, in a conventional manner, an alternating current voltage V_{W3} that is developed across a primary winding W3 of a chopper transformer T4 that is powered by unregulated DC voltage V_{INNR} . An induced

voltage V_{W4} across a secondary winding W4 of transformer T4 is coupled to a conventional rectifier and filter unit 38d that generates, by rectifying voltage V_{W4} , a regulated voltage B+ that is referenced to cold ground conductor 25. Isolation between hot ground conductor 27 and voltage B+ is obtained in a conventional manner by the conductive isolation between windings W3 and W4 of transformer T4. On the other hand, when signal S_{hot} is in the "power-off" state, that occurs when signal $R_{on/off}$ is at the "power-off" state, power supply 38 is turned off by signal S_{hot} causing a voltage B+ to be zero. Thus, windings W3 and W4 are located on the opposite sides of a hot-cold barrier that isolates signals S_{hot} from signal $R_{on/off}$.

In accordance with an aspect of the invention, the regulation of voltage B+ that is referenced to cold ground conductor 25 is performed on the "hot" side of the hot-cold barrier. Signal S_{hot} , that is referenced to hot ground conductor 27, turns on and off, respectively, voltage B+. Advantageously, driver transformer 38e need not serve as an isolation transformer, thereby simplifying the transformer design.

Voltage B+ provides power to a conventional horizontal deflection circuit 39 that produces horizontal deflection current cycles in a deflection winding, not shown in FIGURE 1, in accordance with timing information derived from a horizontal sync signal H_s . Deflection circuit 39 includes a flyback transformer T2, partially shown in FIGURE 1, having a tertiary winding W6 that provides at a terminal 39c of circuit 39 a deflection rate retrace pulse V_{HV} . Terminal 39c is coupled to a high voltage or ultor circuit 40 that produces an ultor voltage U at a level that is determined according to, for example, the positive peak value of pulse V_{HV} . A secondary winding W5 of flyback transformer T2 produces a deflection rate retrace pulse V_{LV} . Each pulse V_{LV} has a positive peak of, for example, 20 volts at a terminal 39b of circuit 39. Because of the tight magnetic coupling of transformer T2, the positive peak voltage of pulse V_{LV} is also representative of the level of ultor voltage U.

Pulse V_{LV} is coupled to an input terminal 37b of on/off control signal generator 37. When the positive peak of pulse V_{LV} exceeds a predetermined threshold voltage, representative of a corresponding level of ultor voltage U, pulse V_{LV} causes signal S_{hot} to be at the second, or "power-off", state, regardless of the state of signal $R_{on/off}$. When signal S_{hot} is in the second state, power supply 38 causes voltage B+ to become zero. When voltage B+ is zero, ultor voltage U becomes zero, because retrace pulse V_{HV} at terminal 39c of transformer T2 is no longer produced. When the positive peak of pulse V_{LV} does not exceed the predetermined threshold level, pulse V_{LV} does not affect signal

S_{hot} . Thus, in accordance with a further aspect of the invention, the information in pulse V_{LV} is coupled to generator 37 for establishing high voltage or X-ray protection.

FIGURE 2 illustrates detailed schematic diagram of on/off control signal generator 37 of FIGURE 1, embodying aspects of the invention. Similar numbers and symbols in FIGURES 1 and 2 indicate similar items or functions. In FIGURE 2, energizing voltage V_{XP} , supplied from standby power supply 33 that is referenced to cold ground conductor 25, is coupled through a current limiting resistor R1 to the cathode electrode of a zener diode CR1 that develops a voltage V_E of 10 volts. Voltage V_E is coupled to the emitter electrode of a transistor Q1. The base electrode of transistor Q1 is supplied, under normal operating condition of ultra voltage U, with sufficient base current to maintain transistor Q1 turned-on so as to couple voltage V_E to the collector electrode of transistor Q1. The voltage at the collector electrode of transistor Q1 is coupled through a current limiting resistor R3 to an end terminal W1a of a primary winding W1 of transformer T3. A filter capacitor C_{Q1} is coupled between terminal W1a and cold ground conductor 25. The other end terminal W1b of winding W1 is coupled to the collector electrode of a transistor switch Q2. The emitter electrode of transistor switch Q2 is coupled to cold ground conductor 25. Control signal S_{cold} , that is referenced to cold ground conductor 25, is coupled through a resistor R4 to the base electrode of transistor switch Q2. Control signal S_{cold} provides, through resistor R4, a train of base electrode current pulses i_b , at the frequency of clock signal CK of FIGURE 1, that flows in the base electrode of transistor switch Q2 of FIGURE 2 throughout the period in which signal $R_{on/off}$ of FIGURE 1 is at the "power-on" state. The train of base electrode current pulses i_b of FIGURE 2 causes the alternate switching-on and switching-off of transistor switch Q2, that is coupled between terminal W1b and cold ground conductor 25. The alternating switching of transistor switch Q2 at the frequency of clock signal CK of FIGURE 1 causes an AC voltage V_{W1} of FIGURE 2 to be developed across primary winding W1. Capacitor C_{Q1} maintains voltage V_{W1} at a substantially constant level when switch Q2 is conductive, for developing an upramping current in winding W1. AC voltage V_{W1} across primary winding W1 is coupled by transformer action of transformer T3 to a secondary winding W2 for developing an AC voltage V_{W2} between a terminal W2a and a terminal W2b that is coupled to hot ground conductor 27.

A demodulator or detector 41 includes a diode CR2. The anode electrode of diode CR2 is coupled to terminal W2a of transformer T3. One plate of a capacitor C3 is coupled to both output terminal 37d

of generator 37 and to the cathode electrode of diode CR2. The other plate of capacitor C3 is coupled to hot ground conductor 27. Diode CR2 rectifies signal V_{W2} in winding W2, that is conductively isolated from cold ground conductor 25, for developing signal S_{hot} at terminal 37d.

In carrying out another aspect of the invention, diode CR2 may be coupled to winding W2 by a passive coupling arrangement such that, for example, signal V_{W2} appears at the anode of diode CR2. Thus, the energy for generating signal S_{hot} may be supplied entirely by signal V_{W2} across winding W2.

Signal S_{hot} that is referenced to hot ground conductor 27 is at a level that is substantially equal to the peak positive voltage of signal V_{W2} that is developed across capacitor C3. The input resistance that is not shown in FIGURE 2, from terminal 38a of power supply 38 to hot ground conductor 27, provides a discharge trickle current path to the charge in capacitor C3 so that signal S_{hot} can change state from the first to the second state when signal S_{cold} is continuously at the "FALSE", or "power-off" state. Thus, when transistor switch Q2 is alternately turned on and off by pulsed signal S_{cold} , corresponding with the "power-on" state of signal $R_{on/off}$, AC signal V_{W2} is developed at secondary winding W2 causing signal S_{hot} to be at the "power-on" state. On the other hand, throughout the period in which input signal S_{cold} is continuously at the "FALSE" state, occurring when signal $R_{on/off}$ of FIGURE 1 is at the "power-off" or second state, transistor switch Q2 of FIGURE 2 is turned-off.

Because switch Q2 is nonconductive in the "power-off" state, voltage V_{W1} is zero in the "power-off" state. Voltage V_{W1} being of zero volts causes signal V_{W2} to be at zero volts; therefore, the resulting signal S_{hot} is at zero volts. As long as signal S_{hot} is at zero volts, power supply 38 stays turned-off. Thus signal S_{hot} , that is conductively isolated from signal S_{cold} , contains the "power-on" and "power-off" information of each of signals $R_{on/off}$ and S_{cold} .

The positive portion of each retrace pulse of voltage V_{LV} is coupled by a series arrangement of a resistor R5 and a diode CR3 to develop across a capacitor C4 a DC voltage V_{C4} that is equal to the positive peak of voltage V_{LV} . Voltage V_{C4} across capacitor C4 is coupled across series coupled resistors R4 and R6. A junction terminal J_{R4} between resistors R4 and R6 is coupled to the base electrode of transistor Q1.

Under normal operating conditions of both voltages V_{HV} and V_{LV} of FIGURE 1, the voltage developed at junction J_{R4} is lower than voltage V_E , developed at the emitter electrode of transistor Q1 of FIGURE 2. Transistor Q1, therefore, stays continuously conductive. On the other hand, when volt-

age V_{LV} of FIGURE 2 exceeds the predetermined threshold level, that was mentioned before, the voltage developed at the base electrode of transistor Q1 is sufficiently high so as to cause transistor Q1 to turn off. When transistor Q1 is turned-off, the collector voltage of transistor Q1 is zero. Therefore, the switching operation of transistor switch Q2 does not produce voltage V_{W1} between terminals W1a and W1b of primary winding W1 of transformer T3. It follows that signal V_{W2} at terminal W2a is zero and signal S_{hot} is forced to be at the second, or "power-off" state. When signal S_{hot} is at the second or, "power-off", state power supply 38 of FIGURE 1 is turned off, causing voltage B+ to become zero. Voltage B+ at zero volts causes voltage V_{HV} and ultor voltage U to become also zero. Thus, when ultor voltage U becomes excessive, generator 37 generates signal S_{hot} at the second, or "power-off" state that causes ultor voltage U to disappear.

A generator 37' of FIGURE 3, embodying another aspect of the invention, is a second embodiment of generator 37 of FIGURE 1. Similar numbers and symbols in FIGURES 1, 2 and 3 indicate similar items or functions. Generator 37' of FIGURE 3 is similar to generator 37 of FIGURE 2 and operates similarly except that in generator 37' of FIGURE 3, signal S_{cold} at output terminal 36a of "AND" gate 36 of FIGURE 1 is coupled directly to terminal W1b of transformer T3. When generator 37' of FIGURE 3 is used in the system of FIGURE 1, it is desirable that "AND" gate 36 of FIGURE 1 have sufficient sinking current capability at terminal 36a when signal S_{cold} is at logical "FALSE" for sinking the current that flows in winding W1 of FIGURE 3. Also, it is desirable that "AND" gate 36 at terminal 36a have sufficiently high breakdown voltage so as to be able to withstand the flyback voltage that is developed at the collector electrode of transistor switch Q2.

FIGURE 4 illustrates a second embodiment of the function performed by the arrangement of remote signal processor 34, "AND" gate 36 and clock generator 35 of FIGURE 1. Similar numbers and symbols in FIGURES 1 and 4 indicate similar items or functions.

In carrying out yet further aspect of the invention, processor 34 of FIGURE 4 may include a microcomputer 34a that generates under program control a signal S'_{cold} that is coupled to line 37e of FIGURE 1. Signal S'_{cold} of FIGURE 4 is substantially equivalent to signal S_{cold} at output terminal 36a of "AND" gate 36 of FIGURE 1.

Claims

1. A power supply apparatus, comprising:
a source (34) providing a first on-off con-

trol signal ($R_{on/off}$) having an on-state and an off-state for providing normal operation on-off control;

means (36) responsive to said first on-off control signal ($R_{on/off}$) for generating a first AC signal (S_{cold}) conductively coupled to said source of on-off control signal, and of constant frequency during one of said on and off-states, and not during the other of said on and off-states;

a signal transformer (T3) having a first winding (W1) coupled to said first AC signal (S_{cold}) for developing, in a second winding (W2) thereof, conductively isolated from said first winding, a second AC signal (V_{W2}) of constant frequency and width during said one state and not during said other state;

a source (30) of input supply voltage (V_{AC}); and

a normal operation power supply (38) coupled to said source (30) of input supply voltage and to said second winding (W2) of said signal transformer (T3) for developing only during the on-state of said first on-off control signal ($R_{on/off}$) an operating voltage (B+).

2. Apparatus according to claim 1 characterized in that said normal operation power supply (38) includes a regulator control section (38c) responsive to said second AC signal (V_{W2}) and conductively nonisolated from said input supply voltage (V_{AC}), and wherein said first on-off control signal ($R_{on/off}$) and said first AC signal (S_{cold}) are conductively isolated from said input supply voltage (V_{AC}), the first (W1) and second (W2) windings of said signal transformer (T3) providing an isolation barrier.
3. An apparatus according to Claim 2 characterized by a demodulator (41) responsive to said second AC signal (V_{W2}) for producing therefrom a second on-off control signal (S_{hot}) having a first state during one of said on and off-states of said first on-off control signal ($R_{on/off}$) and a second state during the other one of said on and off-states of said first on-off control signal ($R_{on/off}$).
4. An apparatus according to Claim 3 characterized in that said second on-off control signal (S_{hot}) is conductively nonisolated from said input supply voltage (V_{AC}) and wherein said first on-off control signal ($R_{on/off}$) is conductively isolated by said transformer (T3) from said second on-off control signal (S_{hot}).



age V_{LV} of FIGURE 2 exceeds the predetermined threshold level, that was mentioned before, the voltage developed at the base electrode of transistor Q1 is sufficiently high so as to cause transistor Q1 to turn off. When transistor Q1 is turned-off, the collector voltage of transistor Q1 is zero. Therefore, the switching operation of transistor switch Q2 does not produce voltage V_{W1} between terminals W1a and W1b of primary winding W1 of transformer T3. It follows that signal V_{W2} at terminal W2a is zero and signal S_{hot} is forced to be at the second, or "power-off" state. When signal S_{hot} is at the second or, "power-off", state power supply 38 of FIGURE 1 is turned off, causing voltage B+ to become zero. Voltage B+ at zero volts causes voltage V_{HV} and ultor voltage U to become also zero. Thus, when ultor voltage U becomes excessive, generator 37 generates signal S_{hot} at the second, or "power-off" state that causes ultor voltage U to disappear.

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Claims

1. A power supply apparatus, comprising:
a source (34) providing a first on-off con-

trol signal ($R_{on/off}$) having an on-state and an off-state for providing normal operation on-off control;

means (36) responsive to said first on-off control signal ($R_{on/off}$) for generating a first AC signal (S_{cold}) conductively coupled to said source of on-off control signal, and of constant frequency during one of said on and off-states, and not during the other of said on and off-states;

a signal transformer (T3) having a first winding (W1) coupled to said first AC signal (S_{cold}) for developing, in a second winding (W2) thereof, conductively isolated from said first winding, a second AC signal (V_{W2}) of constant frequency and width during said one state and not during said other state;

a source (30) of input supply voltage (V_{AC}); and

a normal operation power supply (38) coupled to said source (30) of input supply voltage and to said second winding (W2) of said signal transformer (T3) for developing only during the on-state of said first on-off control signal ($R_{on/off}$) an operating voltage (B+).

2. Apparatus according to claim 1 characterized in that said normal operation power supply (38) includes a regulator control section (38c) responsive to said second AC signal (V_{W2}) and conductively nonisolated from said input supply voltage (V_{AC}), and wherein said first on-off control signal ($R_{on/off}$) and said first AC signal (S_{cold}) are conductively isolated from said input supply voltage (V_{AC}), the first (W1) and second (W2) windings of said signal transformer (T3) providing an isolation barrier.
3. An apparatus according to Claim 2 characterized by a demodulator (41) responsive to said second AC signal (V_{W2}) for producing therefrom a second on-off control signal (S_{hot}) having a first state during one of said on and off-states of said first on-off control signal ($R_{on/off}$) and a second state during the other one of said on and off-states of said first on-off control signal ($R_{on/off}$).
4. An apparatus according to Claim 3 characterized in that said second on-off control signal (S_{hot}) is conductively nonisolated from said input supply voltage (V_{AC}) and wherein said first on-off control signal ($R_{on/off}$) is conductively isolated by said transformer (T3) from said second on-off control signal (S_{hot}).



5. An apparatus according to claim 3 or claim 4 characterized in that said regulator control section (38c) regulates said operation voltage (B+), wherein said regulator control section (38c) is conductively nonisolated from said second on-off control signal (S_{hot}) and said input supply voltage (V_{AC}) and wherein said operating voltage (B+) is conductively isolated from said regulator control section (38c). 5
6. An apparatus according to claim 5 characterized in that said regulator control section (38c) includes a driver transformer (38e) such that each winding of said driver transformer (38e) is conductively nonisolated from said input supply voltage (V_{AC}) and said second on-off control signal (S_{hot}). 10
7. An apparatus according to any one of Claims 3 to 6 characterized in that said demodulator (41) comprises a peak detector that produces said second on-off control signal (S_{hot}) by peak detecting said second AC signal (V_{W2}) in said second winding (W2). 20
8. An apparatus according to any one of claims 3 to 7 characterized in that said demodulator (41) comprises a two-terminal rectifier (CR2) that is coupled to said regulator control section (38c) only via a passive coupling arrangement. 25
9. An apparatus according to any one of Claims 3 to 8 characterized in that said operating voltage (B+) energizes a deflection circuit (39) of a video display apparatus and wherein said second on-off control signal (S_{hot}) is capable of turning on and of turning off said operating voltage (B+), in accordance with said on and off-states, respectively, of said first on-off control signal ($R_{on/off}$). 30
10. An apparatus according to any one of claims 3 to 9 characterized by means (Q1) responsive to a third signal (V_{LV}) and coupled to said demodulator (41) for bringing said second on-off control signal (S_{hot}) to a state which causes said normal operation power supply (38) to be in its off state irrespective of said first on-off control signal ($R_{on/off}$). 35
11. An apparatus according to claim 10 characterized in that said means responsive to the third signal (V_{LV}) comprises a transistor (Q1) having a main current conducting electrode (collector) that is coupled to a first terminal (W1a) of said first winding (W1) for coupling a source (V_E) of energizing current to said first winding (W1), and wherein said third signal (V_{LV}) is coupled to a control terminal (base) of said transistor (Q1) for decoupling said source (V_E) of energizing current from said first winding-when said third signal (V_{LV}) is outside a predetermined range. 40
12. An apparatus according to Claim 11 characterized by a second transistor (Q2) having a main current conducting electrode (collector) that is coupled to a second terminal (W1b) of said first winding (W1) and having a control electrode (base) that is responsive to said first AC signal (S_{cold}). 45
13. An apparatus according to any one of claims 1 to 11 characterized by a second transistor (Q2) having a control electrode (base) that is responsive to said first AC signal (S_{cold}), wherein said first winding (W1) of said signal transformer (T3) has a terminal (W1b) that is coupled to a main current conducting electrode (collector) of said second transistor (Q2) such that said second transistor (Q2) generates in said first winding (W1), a current at said constant frequency in accordance with said first AC signal (S_{cold}). 50
14. An apparatus according to any one of the preceding Claims characterized in that said first on-off control signal ($R_{on/off}$) is generated by a remote control circuit (34), in accordance with a user initiated command (RM). 55
15. An apparatus according to any one of the preceding Claims characterized in that said first AC signal generating means comprises a switch (36) that couples a third AC signal (CK) to an output terminal (36a) of said switch (36) when said first on-off control signal ($R_{on/off}$) is at one of said on and off states and that decouples said third AC signal (CK) from said output terminal (36a) of said switch (36) when said first on-off control signal ($R_{on/off}$) is at the other state.
16. An apparatus according to any one of Claims 1 to 14 characterized in that said first AC signal generating means comprises a microcomputer (34a) that generates said first AC signal (S'_{cold}) such that said first AC signal has a substantially rectangular waveform when said first on-off control signal ($R_{on/off}$) is at one of said on and off-states and at a substantially constant level when said first on-off control signal ($R_{on/off}$) is at the other state.



Patentansprüche

1. Stromversorgungsvorrichtung, umfassend:
eine Quelle (34), die ein erstes EIN-AUS-Steuersignal ($R_{on/off}$) liefert, das einen EIN-Zustand und einen AUS-Zustand hat, um eine EIN-AUS-Steuerung bei Normalbetrieb vorzusehen;

Mittel (36), die auf das erste EIN-AUS-Steuersignal ($R_{on/off}$) ansprechen, um ein erstes Wechselstromsignal (S_{cold}) zu erzeugen, das während eines der Zustände EIN bzw. AUS mit der Quelle für das EIN-AUS-Steuersignal potentialgekoppelt ist und eine konstante Frequenz hat, nicht dagegen während des anderen der Zustände EIN bzw. AUS;

einen Signaltransformator (T3) mit einer ersten Wicklung (W1), der das erste Wechselstromsignal (S_{cold}) zugeführt wird, um in einer zweiten Wicklung (W2), die von der ersten Wicklung potentialgetrennt ist, ein zweites Wechselstromsignal (V_{W2}) mit konstanter Frequenz und Breite während des einen Zustandes aber nicht während des anderen Zustandes zu erzeugen;

eine Quelle (30) für eine Eingangs-Versorgungsspannung (V_{AC}); und

eine Normalbetriebs-Stromversorgung (38), die mit der Quelle (30) für die Eingangs-Versorgungsspannung und der zweiten Wicklung (W2) des Signaltransformators (T3) verbunden ist, um nur während des EIN-Zustandes des ersten EIN-AUS-Steuersignals ($R_{on/off}$) eine Betriebsspannung ($B+$) zu erzeugen.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Normalbetriebs-Stromversorgung (38) einen Regler-Steuerabschnitt (38c) enthält, der auf das zweite Wechselstromsignal (V_{W2}) anspricht und von der Eingangs-Versorgungsspannung (V_{AC}) nicht potentialgetrennt ist, und daß das erste EIN-AUS-Steuersignal ($R_{on/off}$) und das erste Wechselstromsignal (S_{cold}) von der Eingangs-Versorgungsspannung (V_{AC}) potentialgetrennt sind, wobei die erste und die zweite Wicklung (W1) und (W2) des Signaltransformators (T3) eine Isolationsbarriere bilden.

3. Vorrichtung nach Anspruch 2, gekennzeichnet durch einen Demodulator (41), der auf das zweite Wechselstromsignal (V_{W2}) anspricht, um von diesem ein zweites EIN-AUS-Steuersignal (S_{hot}) zu erzeugen, das einen ersten Zustand während eines der EIN- und AUS-Zustände des ersten EIN-AUS-Steuersignals ($R_{on/off}$) hat und einen zweiten Zustand während des anderen der EIN- und AUS-Zustände des ersten

EIN-AUS-Steuersignals ($R_{on/off}$).

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß das zweite EIN-AUS-Steuersignal (S_{hot}) von der Eingangs-Versorgungsspannung (V_{AC}) nicht potentialgetrennt ist, und daß das erste EIN-AUS-Steuersignal ($R_{on/off}$) durch den Signaltransformator (T3) von dem zweiten EIN-AUS-Steuersignal (S_{hot}) potentialgetrennt ist.

5. Vorrichtung nach Anspruch 3 oder 4, dadurch gekennzeichnet, daß der Regler-Steuerabschnitt (38c) die Betriebsspannung ($B+$) regelt, wobei der Regler-Steuerabschnitt (38c) elektrisch von dem zweiten EIN-AUS-Steuersignal (S_{hot}) und der Eingangs-Versorgungsspannung (V_{AC}) nicht potentialgetrennt ist, und wobei die Betriebsspannung ($B+$) von dem Regler-Steuerabschnitt (38c) potentialgetrennt ist.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß der Regler-Steuerabschnitt (38c) einen Treiber-Transformator (38e) derart enthält, daß alle Wicklungen des Treiber-Transformators (38e) nicht von der Eingangs-Versorgungsspannung (V_{AC}) und dem zweiten EIN-AUS-Steuersignal (S_{hot}) potentialgetrennt sind.

7. Vorrichtung nach einem der Ansprüche 3 bis 6, dadurch gekennzeichnet, daß der Demodulator (41) einen Spitzendetektor enthält, der das zweite EIN-AUS-Steuersignal (S_{hot}) durch Spitzengleichrichtung des zweiten Wechselstromsignals (V_{W2}) in der zweiten Wicklung (W2) erzeugt.

8. Vorrichtung nach einem der Ansprüche 3 bis 7, dadurch gekennzeichnet, daß der Demodulator (41) einen Einweg-Gleichrichter (CR2) enthält, der mit dem Regler-Steuerabschnitt (38c) nur über eine passive Kopplungsanordnung verbunden ist.

9. Vorrichtung nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß die Betriebsspannung ($B+$) eine Ablenschaltung (39) einer Video-Anzeigevorrichtung speist, und wobei das zweite EIN-AUS-Steuersignal (S_{hot}) in der Lage ist, die Betriebsspannung ($B+$) gemäß den EIN- bzw. AUS-Zuständen des ersten EIN-AUS-Steuersignals ($R_{on/off}$) ein- und auszuschalten.

10. Vorrichtung nach einem der Ansprüche 3 bis 9, gekennzeichnet durch Mittel (Q1), die auf ein drittes Signal (V_{LV}) ansprechen und mit dem Demodulator (41) verbunden sind, um das



Zweite EIN-AUS-Steuersignal (S_{hot}) in einen Zustand zu bringen, der bewirkt, daß die Normalbetriebs-Stromversorgung (38) unabhängig von dem ersten EIN-AUS-Steuersignal ($R_{on/off}$) in ihrem AUS-Zustand ist.

11. Vorrichtung nach Anspruch 10, dadurch gekennzeichnet, daß die auf das dritte Signal (V_{LV}) ansprechenden Mittel einen Transistor (Q1) enthalten, dessen haupt-stromführende Elektrode (Kollektor) mit einem ersten Anschluß (W1a) der ersten Wicklung (W1) verbunden ist, um eine Speisestromquelle (V_E) mit der ersten Wicklung (W1) zu verbinden, und wobei das dritte Signal (V_{LV}) mit einem Steueranschluß (Basis) des Transistors (Q1) verbunden ist, um die Speisestromquelle (V_E) von der ersten Wicklung zu trennen, wenn das dritte Signal (V_{LV}) außerhalb eines vorgegebenen Bereiches liegt.
12. Vorrichtung nach Anspruch 11, gekennzeichnet durch einen zweiten Transistor (Q2) mit einer haupt-stromführenden Elektrode (Kollektor), die mit einem zweiten Anschluß (W1b) der ersten Wicklung (W1) verbunden ist, und mit einer Steuerelektrode (Basis), die auf das erste Wechselstromsignal (S_{cold}) anspricht.
13. Vorrichtung nach einem der Ansprüche 1 bis 11, gekennzeichnet durch einen zweiten Transistor (Q2) mit einer Steuerelektrode (Basis), die auf das erste Wechselstromsignal (S_{cold}) anspricht, wobei die erste Wicklung (W1) des Signalwandlers (T3) einen Anschluß (W1b) hat, der mit einer haupt-stromführenden Elektrode (Kollektor) des zweiten Transistors (Q2) verbunden ist, so daß der zweite Transistor (Q2) in der ersten Wicklung (W1) einen Strom mit der konstanten Frequenz in Übereinstimmung mit dem ersten Wechselstromsignal (S_{cold}) erzeugt.
14. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das erste EIN-AUS-Steuersignal ($R_{on/off}$) durch eine Fernbedienungs-Steuerschaltung (34) gemäß einem vom Benutzer ausgelösten Befehl (RM) erzeugt wird.
15. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die das erste Wechselstromsignal erzeugenden Mittel einen Schalter (36) enthalten, der ein drittes Wechselstromsignal (CK) mit einem Ausgangs-Anschluß (36a) des Schalters (36) verbindet, wenn das erste EIN-AUS-Steuersignal ($R_{on/off}$) sich in einem der Zustände EIN

bzw. AUS befindet und der das dritte Wechselstromsignal (CK) von dem Ausgangs-Anschluß (36a) des Schalters (36) trennt, wenn das erste EIN-AUS-Steuersignal ($R_{on/off}$) sich in dem anderen Zustand befindet.

16. Vorrichtung nach einem der Ansprüche 1 bis 14, dadurch gekennzeichnet, daß die das erste Wechselstromsignal erzeugenden Mittel einen Mikrocomputer (34a) umfassen, der das erste Wechselstromsignal (S'_{cold}) erzeugt, so daß das erste Wechselstromsignal eine im wesentlichen rechteckige Wellenform hat, wenn das erste EIN-AUS-Steuersignal ($R_{on/off}$) sich in einem der Zustände EIN bzw. AUS befindet, und sich auf einem im wesentlichen konstanten Pegel befindet, wenn sich das erste EIN-AUS-Steuersignal ($R_{on/off}$) in dem anderen Zustand befindet.

Revendications

1. Appareil d'alimentation électrique, comprenant :
 - une source (34) fournissant un premier signal de commande par tout ou rien ($R_{on/off}$) comportant un état passant et un état bloqué pour fournir une commande par tout ou rien de fonctionnement normal ;
 - un moyen (36) sensible audit premier signal de commande par tout ou rien ($R_{on/off}$) pour produire un premier signal de courant alternatif (S_{cold}) à couplage direct avec ladite source de commande par tout ou rien, et de fréquence constante pendant l'un desdits états passant et bloqué, et non pendant l'autre desdits états passant et bloqué ;
 - un transformateur de signaux (T3) comportant un premier enroulement (W1) couplé audit premier signal de courant alternatif (S_{cold}) pour développer, dans son second enroulement (W2), un second signal de courant alternatif (V_{W2}) flottant par rapport audit premier enroulement, de fréquence et de largeur constantes pendant l'un desdits états et non pendant l'autre desdits états ;
 - une source (30) de tension d'alimentation d'entrée (V_{AC}) ; et
 - une alimentation de fonctionnement normal (38) couplée à ladite source (30) de tension d'alimentation d'entrée et audit second enroulement (W2) dudit transformateur de signaux (T3) pour développer seulement pendant l'état passant dudit premier signal de commande par tout ou rien ($R_{on/off}$) une tension de fonctionnement ($B+$).



2. Appareil selon la revendication 1, caractérisé en ce que ladite alimentation de fonctionnement normal (38) inclut une section de commande de régulateur (38c) sensible audit second signal de courant alternatif (V_{W2}) et non flottant par rapport à ladite tension d'alimentation d'entrée (V_{AC}), et dans lequel ledit premier signal de commande par tout ou rien ($R_{on/off}$) et ledit premier signal de courant alternatif (S_{cold}) sont flottants par rapport à ladite tension d'alimentation d'entrée (V_{AC}), les premier (W1) et second (W2) enroulements dudit transformateur de signaux (T3) fournissant une barrière d'isolation.
3. Appareil selon la revendication 2, caractérisé par un démodulateur (41) sensible audit second signal de courant alternatif (V_{W2}) pour produire ainsi un second signal de commande par tout ou rien (S_{hot}) présentant un premier état pendant l'un desdits états passant et bloqué dudit premier signal de commande par tout ou rien ($R_{on/off}$) et un second état pendant l'autre desdits états passant et bloqué dudit premier signal de commande par tout ou rien ($R_{on/off}$).
4. Appareil selon la revendication 3, caractérisé en ce que ledit second signal de commande par tout ou rien (S_{hot}) n'est pas flottant par rapport à ladite tension d'alimentation d'entrée (V_{AC}) dans lequel ledit premier signal de commande par tout ou rien ($R_{on/off}$) est flottant par rapport audit second signal de commande par tout ou rien (S_{hot}) à l'aide dudit transformateur (T3).
5. Appareil selon la revendication 3 ou la revendication 4, caractérisé en ce que ladite section de commande de régulateur (38c) régule ladite tension de fonctionnement (B+), dans lequel ladite section de commande de régulateur (38c) est flottante par rapport audit second signal de commande par tout ou rien (S_{hot}) et à ladite tension d'alimentation d'entrée (V_{AC}) et dans lequel ladite tension de fonctionnement (B+) est flottante par rapport à ladite section de commande de régulateur (38c).
6. Appareil selon la revendication 5, caractérisé en ce que ladite section de commande de régulateur (38c) inclut un transformateur de commande (38e) de façon que chaque enroulement dudit transformateur de commande (38e) soit non flottant par rapport à ladite tension d'alimentation d'entrée (V_{AC}) et audit second signal de commande par tout ou rien (S_{hot}).
7. Appareil selon l'une quelconque des revendications 3 à 6, caractérisé en ce que ledit démodulateur (41) comprend un détecteur de pic qui produit ledit second signal de commande par tout ou rien (S_{hot}) en détectant les maximum dudit second signal de courant alternatif (V_{W2}) dans ledit second enroulement (W2).
8. Appareil selon l'une quelconque des revendications 3 à 7, caractérisé en ce que ledit démodulateur (41) comprend un redresseur à deux bornes (CR2) qui est couplé à ladite section de commande de régulateur (38c) seulement par l'intermédiaire d'un agencement de couplage passif.
9. Appareil selon l'une quelconque des revendications 3 à 8, caractérisé en ce que ladite tension de fonctionnement (B+) active un circuit de déviation (39) d'un appareil d'affichage vidéo et dans lequel ledit second signal de commande par tout ou rien (S_{hot}) est capable de débloquent et de bloquer ladite tension de fonctionnement (B+), selon lesdits états passant et bloqué, respectivement, dudit premier signal de commande par tout ou rien ($R_{on/off}$).
10. Appareil selon l'une quelconque des revendications 3 à 9, caractérisé par un moyen (Q1) sensible à un troisième signal (V_{LV}) et couplé audit démodulateur (41) pour amener ledit second signal de commande par tout ou rien (S_{hot}) dans un état qui entraîne ladite alimentation de fonctionnement normal (38) à être dans son état bloqué indépendamment dudit premier signal de commande par tout ou rien ($R_{on/off}$).
11. Appareil selon la revendication 10, caractérisé en ce que ledit moyen sensible au troisième signal (V_{LV}) comprend un transistor (Q1) comportant une électrode conduisant le courant principal (collecteur) qui est couplée à une première borne (W1a) dudit premier enroulement (W1) pour coupler une source (V_E) de courant d'activation audit premier enroulement (W1) et dans lequel ledit troisième signal (V_{LV}) est couplé à une borne de commande (base) dudit transistor (Q1) pour découpler ladite source (V_E) de courant d'activation dudit premier enroulement lorsque ledit troisième signal (V_{LV}) est en dehors d'une gamme prédéterminée.
12. Appareil selon la revendication 11, caractérisé par un second transistor Q2 comportant une électrode conduisant le courant principal (col-



lecteur) qui est couplée à une seconde borne (W1b) dudit premier enroulement (W1) et comportant une électrode de commande (base) qui est sensible audit premier signal de courant alternatif (S_{cold}).

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13. Appareil selon l'une quelconque des revendications 1 à 11, caractérisé par un second transistor (Q2) comportant une électrode de commande (base) qui est sensible audit premier signal de courant alternatif (S_{cold}), dans lequel ledit premier enroulement (W1) dudit transformateur de signaux (T3) comporte une borne (W1b) qui est couplée à une électrode de conduction du courant principal (collecteur) dudit second transistor (Q2) de façon que ledit second transistor (Q2) produise dans ledit premier enroulement (W1), un courant à ladite fréquence constante en conformité avec ledit premier signal de courant alternatif (S_{cold}).

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14. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que ledit premier signal de commande par tout ou rien ($R_{on/off}$) est produit par un circuit de commande à distance (34), en conformité avec une commande initiée par l'utilisateur (RM).

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15. Appareil selon l'une quelconque des revendications précédentes caractérisé en ce que ledit moyen de production du premier signal de courant alternatif comprend un commutateur (36) qui couple un troisième signal de courant alternatif (CK) à une borne de sortie (36a) dudit commutateur (36) lorsque ledit premier signal de commande par tout ou rien ($R_{on/off}$) est dans l'un desdits états passant ou bloqué et qui découple ledit troisième signal de courant alternatif (CK) de ladite borne de sortie (36a) dudit commutateur (36) lorsque ledit premier signal de commande par tout ou rien ($R_{on/off}$) est dans l'autre état.

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16. Appareil selon l'une quelconque des revendications 1 à 14, caractérisé en ce que ledit moyen de production du premier signal de courant alternatif comprend un microordinateur (34a) qui génère ledit premier signal de courant alternatif (S'_{cold}) de façon que ledit premier signal de courant alternatif présente une forme d'onde sensiblement rectangulaire lorsque ledit premier signal de commande par tout ou rien ($R_{on/off}$) est dans l'un desdits états passant et bloqué et est à un niveau sensiblement constant lorsque ledit premier signal de commande par tout ou rien ($R_{on/off}$) est dans l'autre état.

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